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in the same region as that assigned to the object observed by Captain Maling. It could not possibly have been Schäberle's Comet, because it was far below the horizon at the time of Captain Maling's observations; and moreover this Comet was at the middle of July a very small telescopic object, about 1′ diameter, and, being immersed in the morning twilight, must have been utterly invisible with a small field-glass such as that used by Captain Maling. The facts clearly show that Comets *b* and *c* have been confused, and the former mistaken for the latter.

Ashley Down, Bristol:
1881, *December* 7.

Note on Silvering large Mirrors. By A. A. Common, Esq.

The anticipated difficulty of silvering large mirrors face downwards in the ordinary way, caused me to adopt the plan of silvering the mirror of my three-foot reflector face upwards, in the cell in which it had been made. At first a fairly good film of silver was got in this way, and a source of some anxiety was thought to be got over, as the removal of the silver at intervals of about one year was always contemplated; but subsequent attempts were not so successful, and I determined to try the other way.

As the plan I have designed and used for holding the mirror was quite successful, and is, I think, novel, I propose to describe it, especially as I have little doubt that the use of large reflectors will extend. After considering the various mechanical means that could be used to hold the mirror by the edge or back, or both, any of which would be open to the great objection that they might be causing strain of a most injurious kind, in a way that would not become apparent till perhaps too late, I decided to use the pressure of the atmosphere by the application of something in the nature of a large sucker, from which the air could be withdrawn to get the necessary hold on the back of the mirror, which in this case is about thirty-seven inches in diameter, four and a half inches thick, and weighs over four hundred pounds.

To carry out this idea, I had made a cast-iron box or cell, round in shape and about thirty inches diameter, the rim or side being four inches deep. The edge of this rim was turned quite flat and true, and grooved.

For the purpose of attaching the lifting gear three lugs were cast on the bottom, and iron eyes were fitted to them. Two small taps were fixed in the bottom of this box, to which could be attached flexible tubing.

One of these taps closed the connection of the box with a small vacuum gauge, made for the purpose, of quill glass tube in the shape of the letter U, each leg being about twelve inches long; mercury being poured in till it stood about half way up a rough scale on the board to which the gauge was fixed

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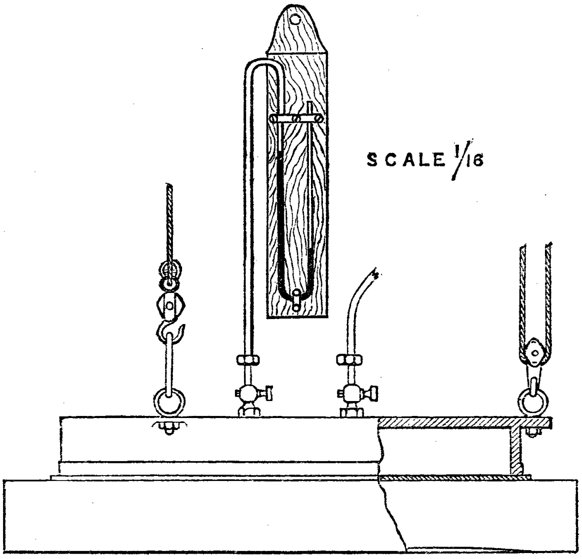
enabled the pressure to be read off pretty closely. The other tap closed the connection of the box with the apparatus for withdrawing the air, which in the first case was my lungs; but, as there was not a back pressure valve, it was found convenient to use a small air-pump, such as is used with a seven-inch bell-glass; sufficient exhaustion could easily be got by the lungs to lift the mirror, with additional pressure for safety.

An indiarubber ring, about one and a half inch wide, and the diameter of the box, was provided to make the joint between the edge of box and the back of mirror.

The box itself might have been made much shallower, but I thought it advisable to have a precaution against the accidental breaking of the gauge or indiarubber tubes. The method of using this apparatus was as follows: the mirror was taken out of the cell and turned face down on a soft bed prepared for it, the indiarubber ring placed central on the back, and the box on the ring. On sucking the air out of the box the pressure made a perfectly tight joint, and any desired degree of exhaustion could be made and kept. Two pulleys were hung from a beam in my workshop, one being attached to two of the eyes, and taking two-thirds of the weight, the other being attached to the other eye. By this arrangement the mirror could be put on edge or lowered flat or at the proper angle to enter the solution so as to drive out any air-bubbles or floating particles. All being ready, the pressure gauge, which was hung up over the box was made to register about five inches of mercury, and the mirror hoisted from its bed, turned on edge, cleaned, &c., all the operations being done in the same order as is usual in silvering smaller mirrors. The back of the mirror has a polished surface, yet the hold of the indiarubber under the pressure then used was very strong—



Side view of apparatus.

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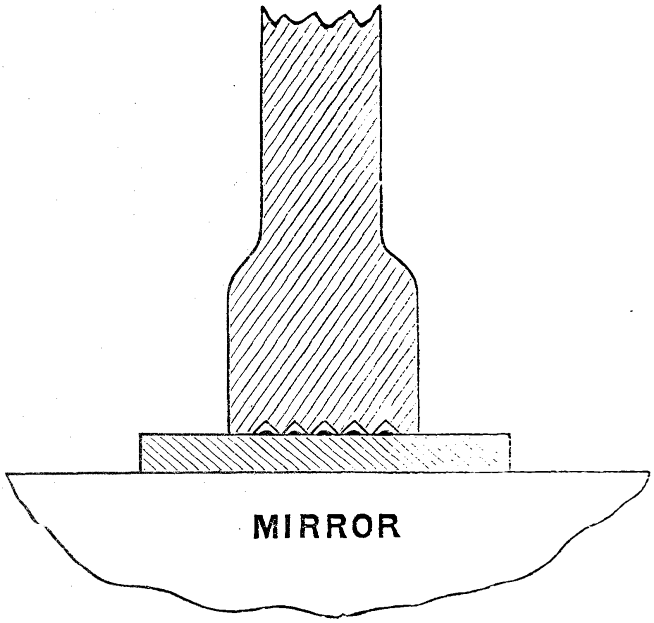
in fact, sufficient to hold the glass edge-up, in which position the tendency to slide off must have been very great. Of course, great care was taken to keep the water from getting on the back of the mirror and into the joint.

A sketch is given showing the arrangement, partly in section, that will complete the explanation. The application of this principle in a more perfect manner, especially for mirrors of comparative thinness, would naturally be to make the box large enough to hold the mirror, the rim acting as a support to the mirror when edgeways, and coming up to about one-half the thickness of edge, when the mirror back was close to bottom of box; then, by making a joint between the edge of mirror and rim of box by a flexible band in such a way that the mirror would be free to move up or down for a short distance, in turning the whole over the pressure of air, as soon as the mirror had dropped out of the box the little necessary distance, would exactly balance or support the whole surface equally. A further extension of the idea would be to make the permanent cell that is always provided to contain the levers and plates act as the box would do, and so always be ready without shifting the mirror; and this plan I shall certainly use if I ever make a larger telescope.



Section showing joint.—Full size.

Several different processes of silvering were tried, but good results could not be obtained, perhaps because the temperature at the time I made the trials was very low, being from 50° to 56° F., or from the reducing agent not being correctly made.

After some experiments, I found the following process answer

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very well, and as the solutions seem to keep well, and are easily made, it may be worth mentioning.

Separate solutions were made of nitrate of silver and caustic potash in the proportion of 1 oz. of each to 10 oz. of water. For the reducing agent glucose was used, and a solution of one half oz. in 10 ozs. of water was made. These three solutions, or any quantity in the same proportion, with liq. ammoniæ and distilled water being ready, the proper quantity was determined on upon the basis that the above quantities would be sufficient for 250 square inches of surface, and used in the following way:—

Ammonia was added to the solution of silver till the turbid appearance first produced had quite cleared; the potash solution was then added, and ammonia again added till the mixture was clear. Then a weak solution of silver was added, drop by drop, till the appearance was decidedly turbid again. The mirror which, before beginning, had been lowered into the dish already containing the proper amount of distilled water, was now lifted up, and the above mixture, together with the glucose solution, poured in and stirred well, and the mirror carefully lowered. At a temperature of about 56° a fine film was got in 43 minutes on the three-foot mirror. I have used some of the same solutions at various times to silver small surfaces, and find I can get a good film in much less time, particularly if the temperature is a little higher. No doubt for higher temperatures some modifications would have to be made, but the use of glucose allows a more certain determination of the proportions proper for certain temperatures than any mixture of sugar and acid, the active properties of which as a reducing agent are uncertain and changeable.

Ealing:
1881, *December* 8.

On a new Form of Transit-Circle with a Prismatic Object-Glass.

By E. J. Stone, M.A., F.R.S.

The proposed form is adapted either for Transit-Circle or Altazimuth, and it appears to me to offer many advantages. I am quite sensible of the difficulties of securing good prisms, but I think they are not insuperable. I have been in communication with Mr. Grubb on the subject, and I hope to give an object-glass of this description a fair trial as soon as Mr. Grubb is sufficiently relieved from the pressure of work in connection with the equipments of the Transit of *Venus* expeditions to undertake the manufacture of the object-glass.

I take for the calculations the following indices of refraction; but others can easily be adopted, if known, for the glass to be used:—